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Tectonics and Metallogeny of the Central Asian Orogenic Supercollage: A Product of Interplay Between the Tethyan and Pacific Oceans

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Recent advances in geochronological studies of Precambrian metamorphic and late Neoproterozoic to early Paleozoic island arc and accretionary wedge terranes provided new insights into the tectonometallogenic evolution of the Central Asian Orogenic Supercollage. The Precambrian terranes consist of Archean to Paleo-, Meso-, and Neoproterozoic continental crust in Mongolia and the Russian Far East/northeast China. Meso- to Neoproterozoic continental crust, with only small terranes of unreworked Paleoproterozoic crust, dominates in the Kazakh Uplands, Tien Shan, and South Gobi. The Precambrian terranes of the Angara and Timan orogens chiefly consist of Neoproterozoic continental crust.

Both previously recognized and underestimated major divides within the Central Asian Orogenic Supercollage coincide with some of the previously mapped early to middle Paleozoic ophiolitic sutures, separating the narrow and continuous Precambrian metamorphic slivers and Neoproterozoic to early Paleozoic arc terranes. The Z-shaped early Paleozoic ophiolitic suture between Mesoproterozoic and Neoproterozoic groups of Precambrian terranes in the south of the Kazakh Uplands and Tien Shan provides a key to recognition of major groups of Precambrian terranes that regrouped several times during the Paleozoic and acted as pediments for several generations of oroclinally bent magmatic arcs.

All diversity of Neoproterozoic magmatic arcs within the Central Asian Orogenic Supercollage can be simplified down to one subduction-accretionary system, now separated into several fragments, often perceived as separate arcs. In the late Neoproterozoic to early Paleozoic, there were two, and, in the middle to late Paleozoic, there were three magmatic arcs—two inside the Central Asian Orogenic Supercollage and one at its eastern periphery in present Mongolia and the Far East. The internal Central Asian Orogenic Supercollage arcs evolved at the active margins of the Paleoasian and Urals oceans, which might have formed an embayment of the Tethys and its predecessors. From the Siberian craton toward the southwest is the general younging of juvenile magmatic arcs inside the Central Asian Orogenic Supercollage since the middle Neoproterozoic to the late Paleozoic. The coeval Transbaikal-Mongolian-Far East arcs are products of the eastward-growing Pacific active margin, a process that continues until the present day in the western Circum-Pacific.

All metallogenic diversity of mineral deposits and their migration in space and time were controlled by these subduction-related and collisional processes. They produced some of the world's largest VMS deposits and medium to giant porphyry copper-(±Mo-Au) deposits. The region is particularly enriched in large to giant and supergiant orogenic gold deposits that formed during multiple collisional events since the late Neoproterozoic to the early Mesozoic. It is also home to some of the world's largest sediment-hosted copper deposits, and the world's largest Ni-Cu-PGE deposits formed on its periphery in relation to Permian/Triassic flood basalt magmatism.